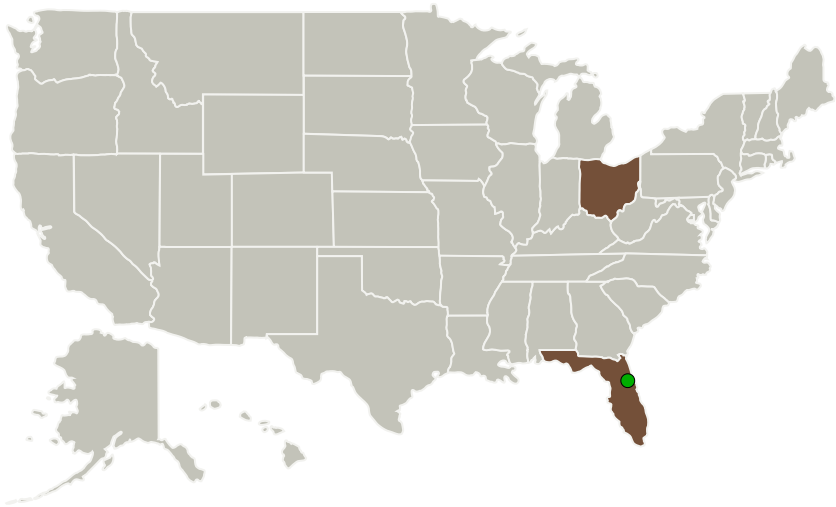
Multi-functional Nano-Reinforced Self-Healing Polymer Matrix Composites, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

This Small Business Innovation Research Phase I project seeks to develop self-healing composites using carbon nanofibers in conjunction with encapsulated resin/hardener. Polymer matrix composites offering multiple advantages of lightweight, high strength and stiffness, vibration damping, and corrosion resistance are becoming widely used in aerospace and commercial applications. A primary weakness of structural composites is damage from impact, where resulting microcracks can propagate to allow delamination and/or fiber breakage of the composite, resulting in loss of the excellent physical properties for which composites are selected. Incorporation of carbon nanofibers (CNF) into the polymer matrix, resulting in a significant increase of the composite interphase, has been shown to mitigate microcrack formation. CNF additives in the matrix have also demonstrated improvement in interlaminar mechanical properties, thermal and electrical conductivity, vibration damping, and fire retardancy. A separate promising tool for addressing damage from impact is the emerging class of self-healing materials, having the ability to heal microcracks and restore mechanical and corrosion-resistant properties of the composite. In the proposed effort, a combination of these tools will be investigated to determine the feasibility of incorporating self-healing, while concurrently producing multifunctional improvements in interlaminar shear strength, modulus, fracture toughness, transport properties, fire retardancy and vibration damping.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Applied Sciences Inc	Lead Organization	Industry	Cedarville, Ohio
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
Florida	Ohio

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138331)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Applied Sciences Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

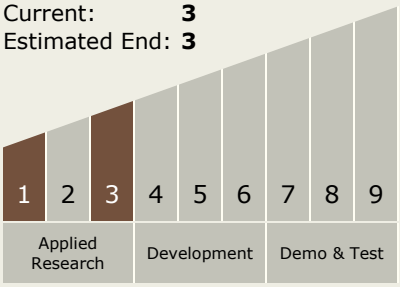
Carlos Torrez

Principal Investigator:

Patrick Lake

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.5 Innovative, Multifunctional Concepts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System